Claims:

1. A current sensor comprising

a) a source of linearly polarized light;

b) a coil of single-mode optical fiber having two ends and one or more turns, which coil is deployed around a conductor which is carrying an electric current to be sensed;

c) two transformers of polarized light for transforming light between linearly polarized and circularly polarized states, said transformers each comprising a birefringent fiber having two ends, which fiber is twisted through an angle about a central axis running therethrough at an appropriate distance from a first end of the fiber, the angle and distance so chosen so that linearly polarized light entering a second end of the fiber exits the first end of the fiber circularly polarized, the first end of which first transformer is coupled to the first end of the coil of single-mode fiber, and the first end of which second transformer is coupled to the second end of the coil;

d) a first directional coupler for optically coupling the linearly polarized light from the source to the second ends of the transformers;

e) an optical detector for receiving the light beams which have traversed the coil and producing an output signal indicative of a magnetic field produced by the electric current; and

f) a second directional coupler for optically coupling the light beams which have emerged from the coil, passed through the polarization transformers, and been rejoined by the first directional coupler to the optical detector.

2. The current sensor of claim 1, wherein the angle is approximately equal to an odd multiple of $\pi/4$ radians, and the distance is approximately an odd multiple of one quarter of a beatlength.

3. The current sensor of claim 2, wherein the angle is approximately equal to $\pi/4$ radians.

4. The current sensor of claim 2, wherein the distance is approximately one quarter of a beatlength.

5. The current sensor of claim 4, wherein the angle is approximately equal to $\pi/4$ radians.

6. A current sensor as in claim 1 wherein the source of linearly polarized light is a diode laser.

7. A current sensor comprising

a) a source of linearly polarized light;

b) a coil of single-mode optical fiber having two ends and one or more turns, which coil is deployed around a conductor which is carrying an electric current to be sensed;

c) two transformers of polarized light for transforming light between linearly polarized and circularly polarized states, said transformers each comprising a birefringent fiber having two ends, which fiber is twisted through an angle about a central axis running therethrough at an appropriate distance from a first end of the fiber, the angle and distance so chosen so that linearly polarized light entering a second end of the fiber exits the first end of the fiber circularly polarized, the first end of which first transformer is coupled to the first end of the coil of single-mode fiber, and the first end of which second transformer is coupled to the second end of the coil;

d) a directional coupler for optically coupling the linearly polarized light from the source to the second ends of the transformers; and

e) an optical detector for receiving the light beams which have traversed the coil and producing an output signal indicative of a magnetic field produced by the electric current, which optical detector is deployed at the rear facet of the source.

8. The current sensor of claim 7, wherein the angle is approximately equal to an odd multiple of $\pi/4$ radians, and the distance is approximately an odd multiple of one quarter of a beatlength.

9. The current sensor of claim 8, wherein the angle is approximately equal to $\pi/4$ radians.

10. The current sensor of claim 8, wherein the distance is approximately one quarter of a beatlength.

11. The current sensor of claim 10, wherein the angle is approximately equal to $\pi/4$ radians.

12. A current sensor as in claim 7 wherein the source of linearly polarized light is a diode laser.

13. A current sensor comprising

a) a source of linearly polarized light;

b) a coil of single-mode optical fiber having two ends and one or more turns, which coil is deployed around a conductor which is carrying an electric current to be sensed;

c) a transformer of polarized light for transforming light between linearly polarized and circularly polarized states, said transformer comprising a birefringent fiber having two ends, which fiber is twisted through an angle about a central axis running therethrough at an appropriate distance from a first end of the fiber, the angle and distance so chosen so that linearly polarized light entering a second end of the fiber exits the first end of the fiber

circularly polarized, the first end of which transformer is coupled to a first end of the coil of single-mode fiber,

d) a reflector connected to a second end of the coil;

e) an optical detector for receiving the light beams which have traversed the coil and producing an output signal indicative of a magnetic field produced by the electric current.

14. The current sensor of claim 13, wherein the angle is approximately equal to an odd multiple of $\pi/4$ radians, and the distance is approximately an odd multiple of one quarter of a beatlength.

15. The current sensor of claim 14, wherein the angle is approximately equal to $\pi/4$ radians.

16. The current sensor of claim 14, wherein the distance is approximately one quarter of a beatlength.

17. The current sensor of claim 16, wherein the angle is approximately equal to $\pi/4$ radians.

18. A current sensor as in claim 13 wherein the source of linearly polarized light is a diode laser.

19. A method of detecting the current in a conductor comprising

a) generating a linearly polarized light beam;

b) dividing the linearly polarized light beam in a directional coupler into two beams,

c) transforming the two linearly polarized light beams into circularly polarized light beams, using polarization transformers, said transformers including a birefringent fiber having two ends which is twisted through an angle about a central axis running therethrough at an appropriate distance from a first end of the fiber, the angle and distance so chosen that a

linearly polarized light beam entering a second end of the fiber exits the first end of the fiber circularly polarized, the transformers arrayed so while the beam emerging from the first end of one is polarized in a clockwise direction, that emerging from the first end of the other is polarized in a counter-clockwise direction;

d) coupling the two circularly polarized beams into opposite ends of a coil of single-mode optical fiber having one or more turns, which coil is disposed around a conductor of electrical current;

e) permitting the beams to pass through the coil in opposite directions;

f) transforming the circularly polarized beams back into linearly polarized beams by means of the polarization transformers;

g) combining the two beams into a combined beam by means of the directional coupler;

h) passing the combined beam through a linear polarizer; and

i) receiving said combined beam with an optical detector for producing an output signal indicative of a magnetic field produced by the electric current in the conductor.

20. The method of claim 19, wherein the angle is approximately equal to an odd multiple of $\pi/4$ radians, and the distance is approximately an odd multiple of one quarter of a beatlength.

21. The method of claim 20, wherein the angle is approximately equal to $\pi/4$ radians.

22. The method of claim 20, wherein the distance is approximately one quarter of a beatlength.

23. The current sensor of claim 22, wherein the angle is approximately equal to $\pi/4$ radians.

24. The method of claim 19 wherein the source of linearly polarized light is a diode laser.

25. A method of detecting the current in a conductor comprising

a) generating a linearly polarized light beam;

b) transforming the linearly polarized light beam into circularly polarized light beams, using a polarization transformer, said transformer including a birefringent fiber which is twisted through an angle about a central axis running therethrough at an appropriate distance from a first end of the fiber, the angle and distance so chosen that a linearly polarized light beam entering a second end of the fiber exits the first end of the fiber circularly polarized, the transformer arrayed so that the beam emerging contains a component polarized in a clockwise direction, and a component polarized in a counter-clockwise direction;

c) coupling the beam into an end of a coil of single-mode optical fiber having one or more turns, which coil is disposed around a conductor of electrical current;

d) permitting the beam to pass through the coil;

e) reflecting the beam at the end of the coil so that it passes through the coil a second time in the opposite direction;

f) transforming the beam back into a linearly polarized beam by means of the polarization transformer;

g) passing the beam through a linear polarizer; and

h) receiving said beam with an optical detector for producing an output signal indicative of a magnetic field produced by the electric current in the conductor.

26. The method of claim 25, wherein the angle is approximately equal to an odd multiple of $\pi/4$ radians, and the distance is approximately an odd multiple of one quarter of a beatlength.

27. The method of claim 26, wherein the angle is approximately equal to $\pi/4$ radians.

28. The method of claim 26, wherein the distance is approximately one quarter of a beatlength.

29. The current sensor of claim 28, wherein the angle is approximately equal to $\pi/4$ radians.

30. The method of claim 25 wherein the source of linearly polarized light is a diode laser.